Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) An engine with variable cycle switchable between a 4-cycle mode and a 2-cycle mode, the engine comprising:

a plurality of combustion chambers each including a cylinder, a piston, an intake valve and an exhaust valve provided in the cylinder, a fuel injection unit for injecting fuel into the cylinder, and an ignition unit for ignition of the fuel within the cylinder; and

a controller that controls an operation of the intake valve, the exhaust valve, the fuel injection unit, and the ignition unit, the controller:

executing a plurality of operation modes in accordance with a combination of one of the 4-cycle mode and the 2-cycle mode with one of a combustion ignition control and a self ignition priority control, the combustion ignition control performing an ignition with the ignition unit at a predetermined timing before top dead center of the piston, and the self ignition priority control performing one of ~~the~~ an ignition without the ignition unit and ~~the~~ an ignition with the ignition unit at a timing delayed from the predetermined timing under the combustion ignition control; and

performing at least one transition cycle upon switching of an operation mode of the engine between a first operation mode and a second operation mode, the first operation mode being performed before the switching, the second operation mode being performed after the switching, and the transition cycle performing an operation of a same cycle type as the second operation mode under the combustion ignition control, wherein:

the transition cycle is different from the second operation mode in at least one of an intake valve opening timing, an intake valve closing timing, an exhaust valve opening

timing, an exhaust valve closing timing, an injection quantity of the fuel, and an injection timing of the fuel; and

the combustion ignition control is executed in one of the combustion chambers where a single cycle of the transition cycle is terminated until each of all the combustion chambers terminates a single cycle of the transition cycle irrespective of the second operation mode under one of the combustion ignition control and self ignition priority control.

2. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 2-cycle mode;

the second operation mode comprises the 4-cycle mode under the combustion ignition control;

each of the transition cycle and the second operation mode has an overlap period at which both the intake valve and the exhaust valve are opened; and

the intake valve opening timing in the transition cycle is delayed from the intake valve opening timing in the second operation mode.

3. (Original) The engine according to claim 1, wherein:

the exhaust valve opening timing in the transition cycle is set to a predetermined timing that is close to the exhaust valve opening timing in the first operation mode; and

the fuel is injected in the first operation mode upon a transition from the first operation mode to the transition cycle, and the exhaust valve is opened in the transition cycle after combustion of the fuel.

4. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 2-cycle mode;

the second operation mode comprises the 4-cycle mode; and

the controller opens the exhaust valve of one of the combustion chambers in

the transition cycle subsequent to combustion of the fuel injected in the first operation mode upon transition from the first operation mode to the transition cycle, and opens the exhaust valve of the other combustion chamber in the transition cycle at a timing 720°/N delayed from the timing at which the exhaust valve is opened in the transition cycle in the one of the combustion chambers where the transition cycle is started.

5. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 2-cycle mode under the self ignition priority control;

the second operation mode comprises the 4-cycle mode under the self ignition priority control; and

an actual compression ratio in the transition cycle is higher than the actual compression ratio in the second operation mode.

6. (Original) The engine according to claim 5, wherein the intake valve closing timing in the transition cycle is earlier than the valve closing timing in the second operation mode.

7. (Original) The engine according to claim 1, wherein:

the first operation mode comprises 2-cycle mode under the self ignition priority control;

the second operation mode comprises the 4-cycle mode under the self ignition priority control; and

the exhaust valve closing timing in the transition cycle is earlier than the exhaust valve closing timing in the second operation mode.

8. (Original) The engine according to claim 7, wherein:

each of the transition cycle and the second operation mode has a period at which the intake valve and the exhaust valve are kept closed from closing of the exhaust

valve to opening of the intake valve; and

the intake valve opening timing in the transition cycle is delayed from the intake valve opening timing in the second operation mode.

9. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 4-cycle mode;

the second operation mode comprises the 2-cycle mode; and

the injection quantity of the fuel in the transition cycle is in a range between 1/2 and 2/3 of the injection quantity of the fuel injected by the fuel injection unit in the first operation mode, and the period from opening of the exhaust valve to opening of the intake valve in the transition cycle is shorter than the period in the second operation mode.

10. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 4-cycle mode under the self ignition priority control;

the second operation mode comprises the 2-cycle mode under the self ignition priority control; and

a period taken from opening of the intake valve to closing of the exhaust valve in the transition cycle is longer than the period in the second operation mode.

11. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 4-cycle mode under the self ignition priority control;

the second operation mode comprises the 2-cycle mode; and

an actual compression ratio in the transition cycle is lower than the actual compression ratio in the second operation mode.

12. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 4-cycle mode under the combustion

ignition control;

the second operation mode comprises the 4-cycle mode under the self ignition priority control; and

the exhaust valve closing timing in the transition cycle is delayed from the exhaust valve closing timing in the second operation mode.

13. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 4-cycle mode under the combustion ignition control;

the second operation mode comprises the 4-cycle mode under the self ignition priority control; and

an actual compression ratio in the transition cycle is lower than the actual compression ratio in the second operation mode.

14. (Original) The engine according to claim 1, wherein:

the first operation mode comprises the 4-cycle mode under the self ignition priority control;

the second operation mode comprises the 4-cycle mode under the combustion ignition control; and

an actual compression ratio in the transition cycle is higher than the actual compression ratio in the second operation mode.

15. (Canceled)

16. (Currently Amended) A method of switching an operation mode of an engine with a plurality of combustion chambers and a variable cycle switchable between a 4-cycle mode and a 2-cycle mode among a plurality of operation modes, the plurality of operation modes including a combination of one of the 4-cycle mode and the 2-cycle mode with one of a combustion ignition control and a self ignition priority control, the combustion ignition

control performing an ignition with an ignition unit at a predetermined timing before top dead center of a piston of the engine, and the self ignition priority control performing one of ~~the~~ an ignition without the ignition unit and ~~the~~ an ignition with the ignition unit at a timing delayed from the predetermined timing under the combustion ignition control, in each of the plurality of combustion chambers, the method comprising the steps of:

(a) executing a first operation mode before switching of the operation mode;

(b) executing a second operation mode after switching of the operation mode; and

(c) executing at least one transition cycle between the first operation mode and the second operation mode, the transition cycle having a same cycle type as the second operation mode, wherein:

the transition cycle is different from the second operation mode in one of an intake valve opening timing, an intake valve closing timing, an exhaust valve opening timing, and an exhaust valve closing timing, a fuel injection quantity, and a fuel injection timing; and

the step (b) includes an execution of the combustion ignition control in one of the combustion chambers having a single operation of the transition cycle completed until the single operation of the transition cycle is terminated in each of all the combustion chambers in the step (c) irrespective of the second operation mode under one of the combustion ignition control and the self ignition priority control.

17. (Canceled)